

CLAIMS

1. A method of cleaning a contaminated material which comprises a solid material which is contaminated with a hydrocarbon, the method
5 comprising the steps of:

(A) contacting the contaminated material with a surface active agent thereby to form a first mixture including said contaminated material and said surface active agent;
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(B) contacting said first mixture with a carrier formulation to prepare a second mixture wherein said carrier formulation is arranged to interact with said surface active agent and/or said hydrocarbon;

15 (C) separating said solid material in said second mixture from other components in the second mixture, wherein said solid material which is separated contains a lower level of said hydrocarbon compared to that in said contaminated material contacted in step (A).

20 2. A method according to claim 1, wherein said contaminated material contacted in the method comprises drill cuttings produced when drilling for oil or gas.

3. A method according to claim 1 or claim 2, wherein said
25 contaminated material is contaminated with a drilling fluid and/or with petroleum.

4. A method according to any preceding claim, wherein said contaminated material comprises at least 5wt% of fluidic hydrocarbon(s).

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5. A method according to any preceding claim, wherein said contaminated material comprises at least 5wt% of oil.
6. A method according to any preceding claim wherein, in the
5 method, a mass of said contaminated material is selected and contacted with said surfactant and the ratio of the wt% of said mass to the wt% of said surfactant is at least 10 and is less than 200.
7. A method according to any preceding claim, wherein said
10 surface active agent includes a hydrophobic moiety which has an aromatic ring system.
8. A method according to any preceding claim, wherein said surface active agent includes an hydrophilic moiety.
- 15 9. A method according to any preceding claim, wherein said surface active agent is an anionic surfactant.
10. A method according to any preceding claim, wherein said
20 surface active agent is wholly soluble in oil of the type contaminating the solid material at 25⁰C.
11. A method according to any preceding claim, wherein said contaminated material contacted in step (A) comprises 10 to 20wt% of
25 hydrocarbon contaminant and 80 to 90wt% of drill cuttings.
12. A method according to any preceding claim, wherein said first mixture contacted in step (B) comprises 100 parts by weight (pbw) of solid material, 10 to 20pbw of hydrocarbon(s); up to 5pbw of surface active agents;
30 and up to 10pbw water.

13. A method according to any preceding claim, wherein said carrier formulation contacted with said first mixture in step (B) includes a carrier which is arranged to interact with a hydrophilic moiety of said surface active material.

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14. A method according to any preceding claim, wherein said carrier includes a polar moiety.

15. A method according to any preceding claim, wherein said carrier is a first polymeric material which includes a multiplicity of cationic moieties.

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16. A method according to claim 15, wherein said first polymeric material includes hydroxyl groups pendent from a polymeric chain.

15 17. A method according to claim 15 or claim 16 wherein said first polymeric material incorporates a polyvinyl alcohol moiety.

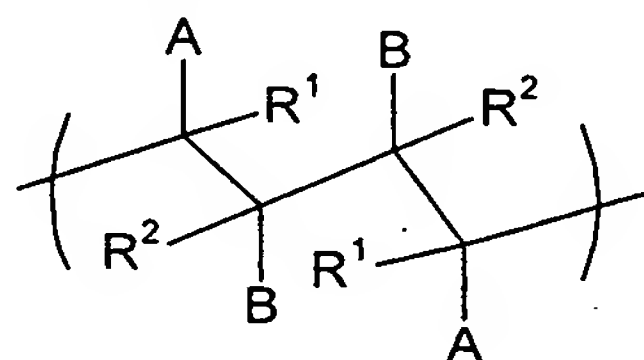
18. A method according to any preceding claim, wherein said carrier formulation is aqueous and includes at least 85wt% of water.

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19. A method according to any preceding claim, wherein said carrier formulation comprises a said first polymeric material which comprises a second polymeric material cross-linked by a third polymeric material, wherein said third polymeric material comprises:

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(i) a third polymeric material having a repeat unit of formula

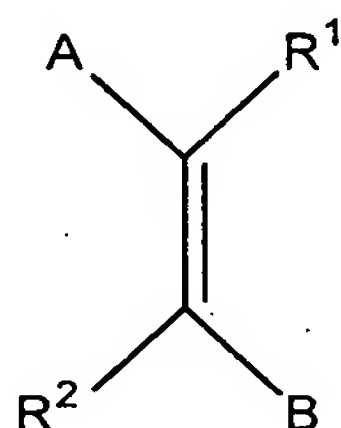


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wherein A and B are the same or different, are selected from.

optionally-substituted aromatic and heteroaromatic groups and at least one comprises a relatively polar atom or group and R^1 and R^2 independently comprise relatively non-polar atoms or groups; or

- 5 (ii) a third polymeric material prepared or preparable by providing a compound of general formula



10 wherein A, B, R^1 and R^2 are as described above, in an aqueous solvent and causing the groups C=C in said compound to react with one another to form said third polymeric material.

20. A method according to claim 19, wherein said third and second polymeric materials are reacted to form said first polymeric material prior to
15 contact with said contaminated material.

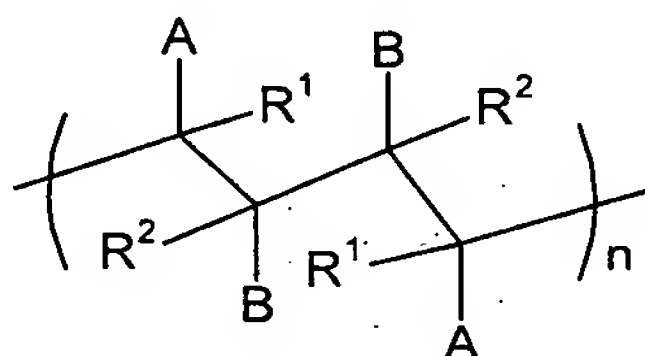
21. A method according to claim 19 or claim 20, wherein, prior to step (B), said method comprises selecting a said third polymer material; selecting a second polymeric material which includes a functional group which
20 is able to react in the presence of said third polymeric material to form said first polymeric material; and causing the formation of said first polymeric material by a reaction involving said third and second polymeric materials.

22. A method according to claim 21, wherein the ratio of the wt% of
25 said third polymeric material to the wt% of said second polymeric material selected for preparation of said first polymeric material is less than 0.1 and is at least 0.01.

23. A method according to any of claims 19 to 22, wherein one of A or B represents an optionally-substituted aromatic group and the other one represents an optionally-substituted heteroaromatic group.

5 24. A method according to any of claims 19 to 23, wherein R_1 and R_2 are independently selected from a hydrogen atom or an optionally-substituted alkyl group.

25. A method according to any of claims 19 to 23, wherein said third
10 polymeric material is of formula:



wherein n is an integer.

26. A method according to any of claims 19 to 25, wherein said
15 second polymeric compound is selected from optionally-substituted polyvinyl alcohol, polyvinyl acetate and polyalkylene glycols.

27. A method according to any of claims 19 to 26, wherein said
20 second polymeric material includes at least one vinyl alcohol/vinyl acetate copolymer.

28. A method according to any preceding claim, wherein in step (B)
said second mixture is mixed to effect intimate contact between the components therein.

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29. A method according to any preceding claim, wherein step (C)
includes allowing solid material to settle.

30. A method according to any preceding claim, wherein after step (B) and before step (C), said second mixture is contacted with further water.

31. A method according to any preceding claim, wherein after step (C) the method comprises, in a step (D), separating components which remain in said second mixture from one another.

32. A method according to claim 31, wherein in step (D), said carrier is caused to form a precipitate.

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33. A method of cleaning a contaminated material comprising a solid material which is contaminated with a hydrocarbon, the method including the steps of:

(A*) contacting the contaminated material with a first polymeric material and/or with second and third polymeric materials of the types described in any preceding claim to prepare a mixture; and
15 (B*) separating solid material which is less contaminated than the contaminated material contacted in step (A) from other components in the mixture.

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34. The use of a first polymeric material and/or second and/or third polymeric materials according to the method as described in any preceding claim in the decontamination of drill cuttings.

25 35. Drill cuttings containing a trace of a first, second or third polymeric material as described in any preceding claim.